

PATTISEEMA LIFT IRRIGATION A HYDRAULIC WONDER: A CASE STUDY IN INTERLINKING RIVERS

ADUSUMILLI ADI LAKSHMI¹ & ALAPATI VENKATESWARLU²

¹Professor, Department of Civil Engineering, Prasad V. Potluri Siddhartha Institute of Technology,
Vijayawada, Andhra Pradesh, India

²Professor, Department of Mechanical Engineering, Velagapudi Ramakrishna Siddhartha College of Engineering,
Vijayawada, Andhra Pradesh, India

ABSTRACT

River linking in India has been a much discussed and debated issue but without any credible initiative and inspiration. Many commissions discussed the concept and left it there itself without translating it into execution and results. The inspiring initiative of Andhra Pradesh government to link its two major rivers Godavari and Krishna through a project called Pattiseema lift irrigation project the First success has been recorded in this arena.

Every year about 2500 to 3000 TMC of water of Godavaririver is going in to the Sea from Dowleswaram Barrage as surplus. Though the Polavaram dam has been planned as a long-term initiative to utilize this water that is going to sea, the immediate water needs of the state necessitated a timely solution. Necessity is the mother of invention.

By utilizing the existing Polavaram Canal infrastructure, and by lifting water from River Godavari (to the extent of 80 to 100 TMC) as the completion of Polavaram Dam would take some more years, engineers proactively designed the Pattiseema Lift scheme so as to reap the early benefits of Polavaram Infrastructure. Pattiseema Lift Scheme is designed to lift 8500 Cusecs of water from River Godavari with 24 Nos of Pumps/Motors. Each Pump discharging 354 Cusecs.

The project was commenced within no time and was completed within a period of one year where all the government machinery worked round the clock to make it happen. When the Godavari river water joined the water of river Krishna, a joy of people knew no bounds. Not only it was the first river linking project but also was completed in record time for which it found its rightful place in Guinness book of world records.

KEYWORDS: *Pattiseema Lift Irrigation, Polavaram & Godavari-Krishna River Linking*

Received: May 31, 2018; **Accepted:** Jun 20, 2018; **Published:** Aug 06, 2018; **Paper Id:** IJMPERDAUG2018101

INTRODUCTION

RIVER LINKING-AN OVERVIEW

Though the river linking was studied by Sir Arthur Cotton before a century, Ideas of River linking was initiated after independence by Dr. KL Rao to address the problem of floods in North India and problem of drought in South India. It is a fact that major North Indian Rivers are perennial in Nature and contain water flow round the year while the peninsular rivers are seasonal and mainly flow in the rainy season. While Northern part of the country suffers from excess the southern part suffers from the deficit. Dr. KL Rao suggested that if the basins of these rivers could be linked this problem could be addressed and the country's water security can be ensured. This idea became popular but could not take off as the resources required were mammoth and inter-basin water transfer was riddled with ecological consequences. Even some agricultural scientists opined that river linking may

have longer agro ecological effects on agro-climatic zones in India thus dividing the focus from the topic. The issue was discussed in parliament and national and international seminars but no substantial work could be done owing to this division of intellectual opinion. Earlier initiatives like Ken- Betwa river linking though a generated lot of heat and dust, could not find the light at the end of the tunnel.

Amid such scenario, the Patti Seema project was spiritedly conceived, silently executed and swiftly completed thus swinging the agricultural prospects of farmers of the entire state of Andhra Pradesh. Patti Seema Lift Scheme is designed to lift 8500 Cusecs of water from River Godavari. This is a record in India to complete a huge Lift Scheme of 8500 Cusecs of discharge, within 1-year time. The Krishna water spared in Krishna Delta because of expansion from Godavari River through Pattiseema was held in Srisailem Reservoir and used for ventures of Rayalaseema i. e., HNSS (HandriNeevaSujalaSravanthi), GNSS (Galeru Nagari Sujala Sravanthi), Telugu Ganga and K. C. Canal (Kurnool-Cuddappah) for drinking, irrigation, and industrial water needs. The Godavari river water is lifted at a place called Pattiseema, a village in Polavaram Mandal of West Godavari District, located on the bank of river Godavari. The lifted water travels around 174 KMs before it joins the River Krishna at Ibrahimpatnam, Krishna district. This project was designed to deliver the following results.

- We can take daily maximum 8500 cusecs (0.73 TMC) of water from Pattiseema.
- Krishna Delta has 13.08 Lakh Ac of ayacut which can produce about Rs.5000 Cr worth crop in every Kharif season. This crop is assured for water thro' Pattiseema.
- The Krishna Delta (W. G, Krishna, Guntur, and Prakasam) can start early crop in the month of **June/July** itself and complete the harvesting by **Sept/October**.
- We can also avoid any **Cyclone damages** during **November**.
- We can send minimum 80 TMC every season to River Krishna. This savings in River Krishna can be sent to Rayalaseema districts from upstream of Srisailem Dam.
- Depending on flood duration we can also send more than 80 TMC through Pattiseema.
- There are an assured drinking water facility to W. G, Krishna, Guntur, and Prakasam districts thro' Right Canal from Pattiseema.
- The areas along the Polavaram Right Canal (in W. G and Krishna) can have assured water facility for commercial crops, Industrial needs and the Ground Water potential can be increased.
- Surplus Godavari water can be fully used by this facility of River Linking.

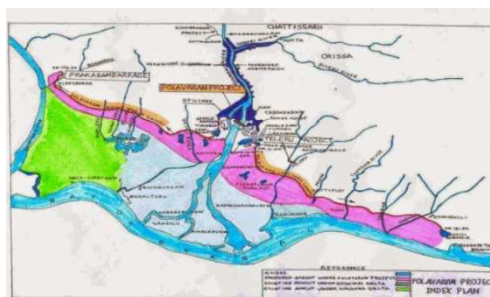


Figure 1: Pattiseema Lift Irrigation a Bird view from Polavaram

Salient Features of the Project

Total discharge: 240 Cumecs (8500cusecs)

Minimum water Level: 14.00 m

Delivery level: 42.50 m

Types of pumps: VERTICALTURBINE PUMPS

No of Pumps: 24 Nos.

Discharge of each pump: 10Cumecs (354 Cusecs)

Pressure main: 12 Rows of 3.2 meters,

Diameter: 18mm thick

Length of pressure main: 3.925 Km (Each Row)

Capacity of each pump: 5300 H. P (3.95MW)

Capacity of each Motor: 6300HP (4.70MW)

Total power required: 113 MW



Figure 2: Pattiseema Lift Irrigation Graphic Design

By supplementing water with this scheme during the critical time, the crops in Krishna Delta can be saved and this was proven when about 2400 Cr worth of paddy was saved during Kharif 2016-17, 2017-18. During the Kharif (2016), about **56 TMC** was lifted and sent through the Polavaram Right Main Canal into River Krishna. During the Kharif season 2017, the Pattiseema lift scheme started delivering water into Right Main Canal from 19.06.2017. About **105.85 TMC** of Godavari water transferred from Pattiseema lift scheme through the right main canal. Around 17 lakh hectares of paddy fields(which is called the rice bowl of India) in Krishna, West Godavari, and Guntur districts.



Figure 3: Pattiseema Lift Irrigation River Canal Flowing at one Place

NEED OF THE HOUR

The government had thought of building a lift water system plot at Pattiseema town in Polavaram Mandal in West Godavari region in January 2015 to rapidly get Godavari water to meet the water system needs of Krishna delta, which began confronting expanded water lack as of late, as the principle venture was relied upon to take a more extended time. The water was intended to balance out 12 lakh sections of land of existing ayacut other than meeting the second product necessities of Krishna delta. One tmc of water is satisfactory to flood 10,000 sections of land of the zone, as per water system engineers. Prakasam Barrage, which bolsters the Krishna Delta (Krishna locale 6.79 lakh sections of land, Guntur area 4.99 lakh sections of land, West Godavari 0.58 lakh sections of land and Prakasam 0.72 lakh sections of land) has around 130 tmc of water allotment yet was not accepting its offer attributable to upstream activities and also the general water shortage in Krishna bowl.

Godavari-Krishna linkage will profit the Krishna delta regarding auspicious accessibility and sufficient amounts of water notwithstanding to raise the second yield, authorities say. The task cost is assessed at Rs 1300 Crores. The primary Polavaram venture was announced as a national undertaking under the AP Reorganization Act, 2014 and was being subsidized by Government of India. Issued managerial endorsements with an expected cost of Rs 4,474 crore in the year 2004, the undertaking cost was raised to minimal over Rs 16,000 crore by 2010-11 while the head works and fundamental dam were still in the Underlying phase of advance.



Figure 4: Pattiseema Lift Irrigation Area Google View

Rayalaseema has a shortage of water and precipitation and is a standout amongst the most vigorously dry season hit spots of South India. On the other hand, the Godavari river is the most overwhelmed stream in South India. There are a Surplus and Deficit. This venture from AP state government is an answer for influencing Rayalaseema Drought to free.

While thousands TMC Feet of water are going to the sea, the lands of Rayalaseema are drying up year after year in search of water. Scanty rainfall forces the region to be under constant water stress and drought-prone conditions. If the region gets some assured supply of water, the state GSDP will increase by leaps and bounds. The rich lands of Rayalaseema will give abundant harvest if the water supply is ensured.

Technology

The lift water system strategy is utilized both for watering of a specific region all in all and for water application to specific hoisted destinations in the region of gravity water system (at that water is lifted from the river or from water system channels). Such blend of gravity and lift water system is fairly sensible much of the time. Water system with which water is provided to the framework by water-lifting gadgets is called pumping/mechanical/lift irrigation (by methods for mechanical water-lifting gadgets).



**Figure 5: Chief Minister of AP Inaugurate
Pattiseema Lift Irrigation**

OPTIMIZATION OF WATER UTILIZATION

The Godavari River is having a good catchment area which is mainly forest covered, in the states of Orissa and Chattisgarh. The dense forest cover facilitates torrential rains and the distance to be traveled by this rain water before it joins the sea is very less. This offers a great opportunity as well as the great challenge. The great challenge because this sudden flow of water is difficult to tame and divert. Great opportunity because if this water is conserved it would cater to the needs of entire Andhra Pradesh thus making it self-sufficient in all its water needs, viz. industrial, agricultural, urban and rural drinking water needs. The two canal systems on the left bank and right bank would cater to the needs of major cities of Vijayawada and Visakhapatnam besides the new capital Amaravathi. Due to the gigantic spending plan of the Polavaram Project and reliance on the local government, it is assessed to take another 5-7 years to complete. The right trench that associates Polavaram venture with Krishna River at Vijayawada was 70-80% complete. Using the correct river which is near prepared, Chief Minister of AP Nara Chandrababu Naidu and his group proposed an undertaking to offer water to Rayalaseema as opposed to sitting tight for 7 more years in drought. Not to influence the Godavari Districts, an extra 1 meter of the cushion was forced on the water level of River Godavari. Once the Godavari water starts reaching the flood level then the water normally is left into the sea from Dowleswaram Barrage. Instead of leaving this water flow into the sea, if it can be lifted and made to flow through gravity, then the productive usage of Godavari river water would be ensured besides mitigating the thirst of the entire state. The Bachawat tribunal award between Maharashtra, Madhya Pradesh, and Andhra Pradesh, allows 80 TMC of water to be channeled from River Godavari to River Krishna. The water that will otherwise flow into sea would now be lifted at Pattiseema, that will supply 80 TMC water to River Krishna, thus saving water flowing into the sea and quenching the thirst of the state of A. P.

Consistently, a common measure of water is discharged from Sri SAILAM Dam to reach Prakasam Barrage for the requirements of Krishna Delta. Through the Pattiseema Lift irrigation project once the Godavari river water reaches the delta lands, the water thus saved in Sreesailam can be utilized for the dry lands of Rayalaseema. The river Krishna that starts from Mahabaleshwar, flows through the states of Maharashtra, Karnataka, Telangana and Andhra Pradesh. The river Krishna flows through the outskirts of Rayalaseema before it gets accumulated at Srisailam and from there water will be discharged further down to Nagarjuna Sagar and afterward down to Prakasam Barrage to serve the necessities of Krishna Delta. The Saved water in River Krishna is distributed to the Rayalaseema through Pothireddypadu set out controller toward its Irrigational and Domestic needs making it a dry season free locale.

FACTSHEET OF THE PROJECT

The Pattiseema lift irrigation project cost is estimated to be Rs 1300 Crores. This project has the capacity to provide irrigation water to around 3 lakh hectares of agricultural land in both Godavari and Krishna districts. The water carried by this project not only ensures timely supply of irrigation water but also deposits a thick layer of fine gravel that enhances the productivity of the soil since Godavari water carries high volumes of sediment from its catchment area. Every year absence of timely rains delayed the arrival of Krishna water into the Srisailam dam and further delayed the arrival of water into the Krishna Delta. The delayed crop cycle adversely affected the productivity of the crops sown in the Krishna Delta Area. If the crop cycle is advanced by one to two months, the productivity will not only be better but also the harvest will not become a victim of seasonal cyclones that arrive in the month of November and December. These reasons compelled the visionary chief minister of Andhra Pradesh to not only envision the project but also set an impossible deadline of 6 months to complete the construction and operationalization of the project which gave this project the credit fastest completed irrigation project in the country. The project was inaugurated on Independence Day, August 15th, 2015, liberating the farmers of Krishna Delta from the recurring problem of shortage of water and non-availability of timely water. The lift irrigation scheme is operated through the specially designed and installed pumps that lift an adequate amount of water. With each pump pumping 10 cubic meters per second, the total capacity comes to around 240 Cubic meters per second. Water thus pumped travels from pattiseema through the right main canal of polavaram project and joins the river Krishna at Ibrahimpatnam in Krishna district. This first ever manmade confluence of two major rivers is named as pavitra Sangamam and chief minister of A. P. was joined by lakhs of Krishna delta farmers in welcoming Godavari river water into Krishna river through a ritual called Jalasiriki Haarati (Offering divine respects to water wealth).



**Figure 6: Pattiseema Lift Irrigation
(Godavari water Meets Krishna Water at Vijayawada)**

The project was expected to lift 80 tmc (trillion metric cubic feet) of surge water in a navigate of 110 days in the midst of the flooding season among July and October from the Godavari as was allowed by the Godavari Water Dispute Tribunal (GWDT) from the progressing Polavaram Multi-purpose Irrigation Project. From this venture, water is pumped up to an adjacent point and released into Polavaram Right Main Canal, which conveys water by gravity to a tributary of River Krishna around 170 km away in the neighboring Krishna locale over the Prakasham torrent. The undertaking contains 24 engines and 24 pumps of 6,300 HP and 5,300 HP separately with a joined ability to release 8,500 cusecs of water. The venture requires 113 mw of capacity to run all the 24 pumps as each engine require 4.7 mw of capacity to lift the water.

SHOWING THE WAY FOR THE COUNTRY

With the launch of the Pattiseema lift irrigation scheme in Andhra Pradesh, the Godavari was formally connected with the Krishna, and the country took a large step towards its ambitious but long-pending goal to interlink major rivers to eventually form a national water grid. At the national level, the river interlinking project will benefit millions of farmers in north India and down the Vindhyas. The Centre has proposed to create 3,000 storage tanks. A whopping 174 billion cubic meters (BCM) of water will be distributed through canals that run for 14,900 km across the county. The Centre has also appointed a high-powered task force on the interlinking of the rivers, which once completed will bring an additional 35 million hectares under irrigation.

CONCLUSIONS

Major benefits of Pattiseema Lift Irrigation Scheme

- The Polavaram Headworks is in progress and about 11% of works are completed so far. Only 5% of the Dam works have been completed.
- Even though the State Government is determined to complete the Headworks including Canal system within 4 years, certain major issues such as inter-state matters with Odisha and Chattisgarh, court cases, Rescue & Rehabilitation issues have to be resolved to stick on to the target date.
- Every year about 3,000 TMC of Godavari water is draining into Sea during the monsoon season.
- With a specific end goal to receive early rewards pending fruition of Polavaram, headworks, the government has endorsed the Pattiseema Lift Irrigation Scheme to lift 8,500 cusecs of water from river Godavari into Polavaram Right Main Canal during the monsoon season, when there is surplus water over the SACB Barrage.
- River Linking: The water will be lifted into the Polavaram Right Main Canal and through Right Main Canal the Godavari water will be occupied into Krishna River above Prakasam Barrage.
- The reason for taking up the project on war-footing basis was to save the backward region of Rayalaseema from drought conditions.
- We can do an irrigation of 1.20 lakh acres in Krishna and West Godavari Districts. Further, about 10 TMC of water is to be supplied for domestic and Industrial use in West Godavari and Krishna
- The river linking encourages in bringing early seed beds up in Krishna Delta and balances out the Krishna Delta ayacut.

- The Krishna water therefore, spared in Krishna Delta because of growth from Godavari River can be held in the Srisailem Reservoir.
- The water saved in the Srisailem reservoir can be used to irrigate the Rayalaseema lands besides filling the water reservoirs and hydro structures of the region, permanently improving the groundwater levels of the region. Improved groundwater levels will help to not only address the long-term drinking water needs of the region but also helps the region to establish its credentials as horticulture hub of the Andhra Pradesh. This will also address the industrial needs of the region which has been languishing in backwardness due to the shortage of water.

Economic and Ecological Benefits

Unlike other irrigation projects, which had to be given several extensions, the PLIS has been completed in the stipulated time of one year. It was the first irrigation project to be completed in the stipulated period. The company MEIL claimed that it was the first-of-its-kind project not only in the sub-continent but also the entire world.

The project was unique because of the diaphragm wall foundations. This is the first time that foundations were designed with diaphragm walls in the irrigation sector. The diaphragm wall design was used either in metro rails or in ports. The design also facilitated working simultaneously on both the substructure and the super-structure which consisted of two slabs - one for the pump and the other for the motor.

Another first was that it was commissioned well before completion. In 161 days the first pump set was commissioned and water was delivered from the Godavari into the Polavaram Right Main Canal on September 18, 2015. Usually, the benefit of an irrigation project can be seen only after completion, but with the PLIS farmers benefited even before the project was completed.

Criticism

Pattiseema may prove to be **harmful to the environment**. Interlinking of rivers is fraught with **ecological loss**. Since the rivers have different environments, lifting water may **affect aquatic life**.

The new canal will recharge the groundwater more than needed. This will lift up the **water table** abnormally, causing **damage to the root system** of the plants and crops all along the canal.

The Pattiseema is linked to the (river) Budameru diversion channel. If there's **flooding in Budameru**, Vijayawada, **parts of Krishna and West Godavari districts may be affected**. Farmers in **West Godavari** fear that **inflow** into Godavari delta system will get **reduced** if water is diverted to Krishna.

Ecologists apprehend possible long-term impact on the river ecosystem and its surroundings, once the Godavari water with different ingredients and marine organisms, forcibly try to coexist with the Krishna river ecosystem. This may also have long-term implications on the groundwater situation in the surrounding areas.

There will be the loss of habitat. When the marine organisms from two river ecosystems clash some vulnerable species may extinct without being able to survive in the hostile ecosystem. The changes in the amount of sedimentation carried by the two rivers also will have an impact on the marine organisms that live in the connected canals system. The physical and chemical compositions of water carried by two rivers with different sedimentation levels will alter the groundwater characteristics also.

REFERENCES

1. Rathinasamy Maria Saleth, "Strategic Analyses of the National River Linking Project (NRLP) of India (Series-3)".
2. Andhra Pradesh Manual, AP's river-linking project.
3. Dharmendra MEHTA, Naveen K. MEHTA, "INTERLINKING OF RIVERS IN INDIA: ISSUES & CHALLENGES".
4. In Civil Engineering Manual, Interlinking of rivers in India.
5. Lift irrigation - Methods and practices: A manual by Mihir Maitra (AFPRO). a India water portal
6. Sri. A. Venkateswara Rao., Superintending Engineer (Retd.) "PLANNING & DESIGN OF LIFT IRRIGATION SCHEMES".
7. George, M. M. C., Korgaonkar, P. D., & Geetha, K. (2014). Interlinking of river basins, a review. *International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development*, 4(2), 33-46.
8. Sri SasibhushanKumarIAS secretary Irrigation Government of AP "Benefits of Pattiseema Lift Irrigation Project"

